WILDLIFE ROADKILLS
AND
POTENTIAL MITIGATION
IN
ALBERTA

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February 1983

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This report may be cited as:

Sanderson, Kim. 1983. *Wildlife Roadkills and Potential Mitigation in Alberta.* ECA83-ST/1.
Edmonton: Environment Council of Alberta. 10 pages.

ECA83-ST/1

INTRODUCTION

Although it is difficult to accurately determine the number of wild animals killed as a result of animal/vehicle collisions in Alberta, it is reasonable to assume that this number is increasing as our road system is expanded to accommodate more vehicles and provide access to more remote areas. Improvements to highways mean that more vehicles can travel at higher speeds and in areas of wildlife habitat, collisions with animals are certain to occur.

This report looks at the seriousness of the road kill problem in Alberta with regard to damage to wildlife and damage to persons and property and also provides a discussion and assessment of various mitigation measures.

ANIMAL/VEHICLE COLLISIONS IN ALBERTA

Animal/vehicle collisions represented approximately 3 percent (2,992) of all reported accidents which occurred in Alberta in 1980; of these collisions, only 4.9 percent (147) resulted in human injury and there were no human fatalities (Alberta Transportation 1982). In 1978, the first year for which such data were available, 6 percent of animal/vehicle collisions resulted in personal injuries and there were two fatalities (Damas and Smith 1982). It is estimated that a total of three million dollars worth of property damage occurred in 1980 as a result of animal/vehicle collisions (Alberta Transportation 1982). The estimated average amount of vehicle damage per accident was approximately $1,000 but damage exceeded this amount in 30 percent of collisions (see Table 1). Accidents can also occur when drivers swerve to avoid animals and subsequently collide with other vehicles or stationary objects or go out of control. Injuries and damages resulting from such accidents would not be included in the above figures and their extent would be difficult to determine.

Table 1.

Total vehicle damage in collisions with animals, 1980

Damage $	Accidents No.	Accidents %
1- 350	83	2.8
351- 500	673	22.5
501-1000	1215	40.6
1001-2000	640	21.4
2001-3000	170	5.7
3001-4000	53	1.8
4001-5000	25	0.8
over 5000	24	0.8
unspecified	109	3.6
TOTAL	2992	100.0

Source: Alberta Transportation 1982

Table 2 summarizes the number of traffic accidents involving wild and domestic animals in Alberta from 1978 to 1981. However, Damas and Smith (1982) suggest that these figures may underestimate the number of large wild animals killed by a factor of between 5 and 10. They report that even in national parks where the RCMP are sensitized to the problem of animal/vehicle collisions, the police only record about one third as many wildlife mortalities as recorded by the Warden Service; that is, "for each animal/vehicle collision recorded by the RCMP, approximately three animals are killed" (page 25).

Table 2.

Number of motor vehicle accidents involving animals, 1978-81

	1978	1979	1980	1981**
Domestic	449*	495*	668	584
Wild	1440*	1542*	2324	1647
TOTAL	1889	2037	2992	2231

Source: Alberta Transportation 1982

* Numbers of domestic and wild animals for 1978 and 1979 were calculated using a ratio of three wild animals to one domestic animal, as established by the figures for 1980 and 1981. Only the totals for 1978 and 1979 were available. This table includes data from the national parks.

** Prior to 1981 detailed information was collected by police on collisions involving death, injury, or property damage in excess of $350.00. In 1981, this minimum was increased to $1,000.00, so that 1981 figures are not directly comparable to data for previous years.

More than 90 percent of animal/vehicle collisions kill the animal outright or injure it so severely it cannot survive. The latter case results in more errors in reporting. Collisions in which an animal's leg is broken, for example, may not result in immediate death, but it is unlikely the animal will recover; furthermore, such an injury could occur with only minor damage to the vehicle, and thus may not be

reported. Although the provincial figures for 1981 (see Table 2) indicate a decline in animal/vehicle collisions, this more likely reflects the change in reporting procedures. Prior to 1981, detailed information was collected by police on collisions involving death, injury, or property damage exceeding $350; in 1981, this minimum was increased to $1,000.

These data can perhaps be put into perspective by comparing them with the numbers of animals taken by hunters. It is assumed that mitigation (for example, fences) is already in place to protect domestic animals, and that any concern is directed toward wildlife. In Alberta, mule deer and white-tailed deer are the species most often involved in animal/vehicle collisions outside the national parks, and these species are also popular with hunters. Nearly 144,000 licences were issued for mule deer and white-tailed deer during the 1981-82 hunting season; assuming an average hunter success rate of 25 percent, this means approximately 36,000 deer were harvested by hunters. Recent population estimates of mule deer and white-tailed deer were 100,000 and 140,000 respectively, for a total of 240,000 deer (Fish and Wildlife Division 1982). In 1980, approximately 2,000 animals, not all of which were deer, were killed in collisions outside the national parks. Even if these recorded road kills represented only 10 percent of the actual total, the number of deer involved is substantially fewer than the number taken by hunters, and is only about 8 percent of the total population.

Table 3 indicates that in 1980, 88.9 percent of the accidents involving animals occurred in rural areas on highways and secondary roads. Highways within the national parks are high-risk areas for wildlife. In Jasper National Park, for example, it was determined that 10.2 percent of all reported motor vehicle accidents involved animals, compared with about 3 percent in Alberta as a whole, and about 1.6 percent on provincial road systems across Canada (Damas and Smith 1982). Banff and Jasper national parks experience the highest numbers of recorded large mammal mortalities of all the national parks in Canada; Banff averaged 84 mortalities and Jasper 80 per year during the period 1970-1980 (Damas and Smith 1982). The current level of mortality is considered to be having a significant impact on some populations of elk, mule deer, moose, and bighorn sheep in Banff National Park (Holroyd 1980, Damas and Smith 1982). This means that mortality due to animal/vehicle collisions exceeds 50 percent of a population's annual productivity. Most of the road kills in Banff occur on the Trans Canada Highway; the proposed improvements to this highway and the associated public hearings have resulted in extensive research and documentation of the problem of wildlife road kills and potential mitigating measures.

Outside the national parks in the agricultural and parkland regions of central Alberta, white-tailed deer and mule deer are the large animals most frequently involved in collisions; accidents involving moose and elk become more common in the forested Green Area of the province. Some effort has recently been made to document wildlife road kills in Kananaskis Country in the foothills southeast of Banff. In this area, deer were the major species affected by road kills, followed by elk and bighorn sheep (Pall 1983: pers. comm.). Upgrading of the main highway through Kananaskis Country and the resultant increase in traffic could increase wildlife road kills in that area.

It can be very difficult to determine the actual number of animals killed, for various reasons, some of which have been mentioned. Bruns (1976) indicated in his study that carcasses of road-killed deer were salvaged by motorists for human consumption or pet food, and some were simply cleared by highway maintenance crews. If the accident was never reported, such mortalities would not be included in data collection. Another complicating factor is that various agencies compile data on road kills and the criteria used are not necessarily consistent. The

Table 3. Location of motor vehicle accidents involving animals, 1980

	Domestic		Wild		Total	
	No.	%	No.	%	No.	%
Rural	600	89.8	2060	88.6	2660	88.9
Urban	52	7.8	119	5.1	171	5.7
Unspecified	16	2.4	145	6.2	161	5.4
TOTAL	668	100.0	2324	99.9	2992	100.0

Source: Alberta Transportation 1982

RCMP, Alberta Transportation, park wardens, Fish and Wildlife staff, and automobile insurance companies all have data on animal/vehicle collisions, but the objectives vary and so does the manner in which the data are collected.

FACTORS AFFECTING THE NUMBER OF ROAD KILLS

Animal Behavior

The activities of wild animals, although not always predictable, often do show some pattern over a period of time. Many species of wildlife exhibit patterns of circadian and seasonal movement, and in locations where highways are adjacent to or bisect areas through which these animals move, animal/vehicle collisions are virtually certain to occur.

Data from Banff National Park and elsewhere indicate that for wildlife species in general, road kills peak in the periods between 0600 hrs. and 0800 hrs., and between 1800 hrs. and 2400 hrs. (Allen and McCullough 1976, Flygare 1979, Damas and Smith 1982). This trend is also apparent in data compiled by Alberta Transportation; although most of the recorded traffic accidents which occurred in Alberta in 1980 happened during daylight hours, 81 percent of the collisions involving animals took place during periods of dawn, dusk, or darkness (Alberta Transportation 1982). A driver's field of view is reduced during these hours, and many wildlife species are most active at these times, increasing the likelihood of collisions.

Seasonal variation in mortality has also been observed by numerous researchers. Seasonal migrations are characteristic of many wildlife species, as requirements for winter habitat are often different from those for other times of the year. Other behavioral traits, including reproductive behavior, are also associated with seasonal changes. Peak periods of mortality seem to vary from species to species, but generally late autumn peaks are most frequently recorded (Puglisi et al. 1974, Allen and McCullough et al. 1976, Flygare 1979, Environmental Assessment Review Panel 1981). Table 4 reveals that 41 percent of the animal/vehicle collisions recorded in Alberta in 1980 occurred in October, November, and December. In addition to any movement associated with migratory behavior, this is the rutting period for ungulates, and marked increases in population movement are associated with the breeding season. As well, hunting activities may be generally disturbing to animal populations, resulting in increased movement.

Increases in ungulate mortality have also been noted in spring months (Puglisi et al. 1974, Flygare 1979), and in many cases this is thought to be related to improved grazing opportunities along highway rights-of-way as high-quality forage becomes available. This may be especially significant for some populations because many females are pregnant at this time and their death represents a significant loss in biological potential (Harrison et al. 1980). Some observations of increased mortality of male deer in spring months may be related to the fact that yearling males are abandoned by their dams at this time of year (Puglisi et al. 1974). Data from the Kananaskis area support these trends, as peak mortality periods have been observed in June and October since 1978 (Pall 1983: pers. comm.).

Table 4.

Seasonal distribution of animal/vehicle collisions, 1980

Season	No.	%
Winter (Jan–Mar)	292	9.8
Spring (Apr–Jun)	569	19.0
Summer (Jul–Sep)	736	24.6
Autumn (Oct–Dec)	1237	41.3
Unspecified	158	5.3
TOTAL	2992	100.0

Source: Alberta Transportation 1982

Highway Conditions

The overall design of transportation corridors can have an impact on wildlife populations and may contribute to the number of road kills. In areas of known wildlife habitat, the actual location of the highway can be the most critical factor; main problem sites in the national parks occur where highways bisect or lie immediately adjacent to a particular species' habitat, or between areas of summer and winter habitat (Damas and Smith 1982). However, this appears to be less critical when the highway passes through an open field rather than a forested area (VIOL 1980). Ideally, wildlife habitat requirements would be considered in the planning and design of new transportation corridors, so as to avoid the necessity for mitigation measures at a later date.

In such cases adequate lead time is required for wildlife biologists to obtain reliable data on animal behavior and patterns of movement.

Characteristics of the transportation corridor itself may predispose a particular location to increased numbers of road kills. Curves or hills which restrict drivers' vision, particularly at night, or the presence of intersecting side roads along which animals move, can give rise to local "hot spots" where road kills repeatedly occur. Many such spots have been identified in the national parks (Damas and Smith 1982) and in the Pine Lake area near Red Deer (Bruns 1976), and regional wildlife biologists throughout the province are no doubt aware of similar sites in their own areas.

There seems to be conflicting evidence as to whether road kills are greater on twinned highways (Reilly and Green 1974), or on paved but undivided highways (Allen and McCullough 1976). A study by Bruns (1976) of deer road kills in the Pine Lake area indicated that the number of deer killed per mile of divided highway was 1.2 times the number killed on paved two-lane roads, but 32 times the number killed on gravel roads. One of the problems with such comparisons may be that divided highways are more heavily used, thus the number of vehicles would be greater on both a daily and an annual basis, increasing the probability of heavy traffic when animals are likely to be present and active.

Animal/vehicle collisions occur even on roads with reduced speed limits, suggesting that the number of vehicles may be a more important factor than traffic speed. In fact, a study of vehicle collisions with bighorn sheep in Banff National Park indicated that reducing speed limits and installing "no stopping" signs along a portion of the Trans Canada Highway reduced the number of traffic accidents, but did not affect the number of sheep killed (Flygare 1979). Furthermore, on major thoroughfares which are designed to carry high-speed traffic, it is impractical and could be quite dangerous to reduce speed limits in order to achieve a reduction in road kills.

Associated with roads with high design speed are other factors which may attract animals to the roadside. Increased use of de-icing salt has been implicated as a factor affecting bighorn sheep mortality on the Yellowhead Highway in Jasper National Park (Van Tighem 1981). Studies have shown that ungulates are attracted mainly by the sodium contained in road salt, and that although the desire for sodium is usually highest in spring and early summer, some ungulates will consume it at any time (Damas and Smith 1982). In addition to licking salt from the highway surface, animals can also obtain sodium by drinking salt water from puddles or by licking salty soil at the roadside; both of these sources would be available in Alberta long after applications of de-icing salt had ceased for that season.

Vegetation on highway rights-of-way is often attractive to wildlife as a source of food. To improve drivers' field of view, rights-of-way on high-speed highways are usually cleared quite extensively, then seeded to grass. Such vegetation is ideal for grazing animals and is often easily accessible; the terrain is frequently banked and smoothed, providing few obstacles to hungry herbivores.

MITIGATION MEASURES

When new transportation corridors are being planned, wildlife habitat and behavior should be considered. However, given that re-routing of existing highways with established kill sites would be impractical, mitigation measures to reduce road kills could be considered in such areas. Damas and Smith (1982) provide an extensive review of mitigation measures, many of which are briefly considered in this report. They indicate that steps can be taken to (a) keep animals off the road, and/or (b) improve drivers' awareness of the problem. Included in the first approach are methods involving active restraint (that is, physical barriers such as fences), and methods of passive restraint, which require an understanding of factors causing the problem, including animal behavior. Generally, active restraint techniques are effective but costly, while methods of passive restraint may be cheaper but can be less effective and/or may take a long time to become effective. A combination of techniques can sometimes provide an acceptable compromise of cost and effectiveness.

Fences and Ancillary Structures

Preventing access to highway rights-of-way is generally considered to be the most effective method for reducing ungulate road kills. Harrison et al. (1980) and Damas and Smith (1982) provide extensive

reviews of various fencing studies, most of which have been done in the US or Sweden.

Complete or "restrictive" fencing must be long enough to extend beyond the movement range of animals or else must be supplemented by gates or other structures which prevent animals from gaining access to the highway where the fence ends. The commonly accepted fence height to contain mule deer and white-tailed deer is 2.5 metres; however, elk are capable of jumping such fences, particularly when harassed or in rut (Harrison et al. 1980). A variety of fence types have been studied and it seems that considerable scope exists in this regard as long as fence maintenance is rigorous (Damas and Smith 1982). One problem with fencing is the development of bottom gaps due to soil erosion, fence construction, and animal digging. As well, in areas of heavy snowfall, snow build-up can occur, reducing the effective height of the fence, and enabling animals to jump it with ease.

When restrictive fencing is used, there should be provision for animals which have managed to gain access to the right-of-way to escape; one-way gates have been used successfully for this purpose (Reed et al. 1974).

Often associated with continuous fencing and one-way gates are structures which enable migrating animals to safely cross a highway. When used in conjunction with well-maintained fencing, these underpasses or overpasses can be successful, especially if they are properly designed and located. For such structures to succeed, considerable biological data and species-specific behavioral knowledge are required (Damas and Smith 1982). For example, most ungulates need a large field of view to feel secure; thus culverts and box concrete underpasses would not be acceptable to most ungulates since they restrict the animal's lateral vision (Harrison et al. 1980). Also, the floor of the approach and structure should be consistent with natural surroundings to reduce the animals' apprehension. Harrison et al. (1980) documented a number of studies which consider the security requirements of ungulates; they also mention the success of baiting programs which were initiated to attract ungulates to the underpasses and overcome the animals' initial reluctance to use the structures.

The major drawbacks to the use of fencing and ancillary structures as mitigating measures are the high capital costs, especially if crossover structures are needed, and the ongoing maintenance which is required if the fence is to be effective. In areas such as the national parks, aesthetics can be an important factor too, as unsightly fences detract from the beauty of the natural environment. A detailed analysis and description (including cost estimates) of fencing and crossing structures proposed for the Trans Canada Highway in Banff is available (Public Works Canada 1981). In the case of the Trans Canada Highway through Banff, fencing and crossover structures in the twinned section seemed to be the best choice for mitigation; the Bow Valley is the wintering area for a number of ungulates, and road kills were having a significant impact on the populations.

Where the incidence or risk of animal/vehicle collisions is high but localized due to biological or topographical conditions, short "leading" fences can be effective. Animals are redirected along the fence and are allowed highway access at the ends of the fence where they can cross more safely or where the attractiveness of the right-of-way is reduced. The location and length of leading fences depend on accident distribution and on the species of wildlife involved.

Although fencing is the most effective mitigation method, it is very costly, and its use may be warranted only in particular areas. Fencing costs vary with the type of fence used, access, substrate, and other factors. Damas and Smith (1982) indicate that a top-quality chain link fence 2.44 metres (8 feet) in height would cost about $30,000 per kilometre, installed. This cost does not include any gates or crossover structures that might be required.

Various methods of passive restraint have been tested with different degrees of success. However, the combination of several of these techniques or the use of leading fences with one or two other methods (including improving drivers' awareness) may also prove to be sufficiently effective. It should be stressed that knowledge of animal behavior is essential if successful mitigation is to be implemented. A variety of passive restraint measures are discussed in the next section.

Psychological Barriers

Various reflective devices have been assessed for their effectiveness at discouraging animals from crossing highways at night. The theory is that these reflectors and mirrors, arranged along the highway edge, reflect light from the headlights of passing vehicles onto the right-of-way, startling any animals present and deterring them from moving onto the highway. **Stratolite** and **Van de Ree** mirrors are made of plastic and stainless steel respectively, while **Swareflex** reflectors contain a set of prisms in a red plastic housing. The red beam which the latter produces is reportedly an effective deterrent, but other studies have indicated that ungulates are color-blind (Harrison et al. 1980). Swareflex reflectors were installed along a portion of highway in south-central Alberta in 1979 by the Alberta Fish and Game Association and the Fish and Wildlife Division of Alberta Energy and Natural Resources (Damas and Smith 1982). The study was ended after two years without any results; most of the reflectors were destroyed by vehicles and vandals in the first year. Swareflex reflectors were also tried in Banff National Park in 1978 with little success (Flygare 1979). Reflective devices have numerous drawbacks: they are only useful after dark, they are ineffective on foggy and snowy nights, they lose their reflective ability when corroded, they interfere with snowplowing, and they have a high maintenance cost as well as being costly initially (Flygare 1979). Although studies of reflective devices have been somewhat inconclusive, the general consensus seems to be that in certain conditions reflectors are effective for a year, at most, and the drawbacks outweigh the questionable advantages.

Some work has also been done to test the response of animals to various sounds, on the theory that a sonic barrier could be used to frighten wildlife away from roadside areas. Tests with firearms and explosives indicated that results were only temporary – ungulates soon learned to ignore these noises, which were perceived as non-threatening. It is known that animals respond to key stimuli such as alarm calls, distress calls, and predator sounds, so that species-specific studies in this area might yield more promising results (Damas and Smith 1982).

Habitat Manipulation

To discourage ungulate use of roadside rights-of-way, these areas can be made less attractive to ungulates and/or prime-quality habitat can be created in locations distant from the transportation corridor. Damas and Smith (1982) suggest that a combination of both should produce a cost-effective solution for redistributing populations of large mammals.

One approach commonly considered is the management of roadside vegetation so that plant species which are unpalatable to ungulates are dominant. This technique requires clearing then seeding the right-of-way to unpalatable plants. However, grasses which are desirable for revegetation grow quickly and are also highly nutritious and palatable. Furthermore, many ungulates are adaptable in their tastes, and no grass species which is suitable for revegetation purposes is entirely unpalatable to ungulates (Harrison et al. 1980). Covering the right-of-way with concrete or asphalt is a possibility, but this would be costly, aesthetically unpleasing, and would affect water run-off and drainage in adjacent areas.

Another approach which has been tried is to improve highway illumination, the theory being that the brightly lit roadside area will compromise the animal's security and therefore make the roadside area less attractive. However, in addition to being costly, this method was found to be ineffective at reducing deer/vehicle accidents (Reed and Woodard 1981).

Various chemical repellents have also been tested as a means of reducing the attractiveness of vegetation to wildlife. Such compounds have been in use for several decades to protect forest and orchard crops from browsing animals. However, this is a very specific use and it is relatively easy to assess the efficacy of chemicals used for this purpose. Only two products are now registered for use in Canada as ungulate repellents; they are **Thiram** and **Hinder**, both of which are used in forestry and agriculture. Hinder was originally developed as a component of pesticide sprays, and can therefore be applied to large areas of vegetation at reasonable cost; it probably acts as a short-to-long-range olfactory repellent, but as yet there have been no major scientific studies showing the effectiveness of this characteristic (Damas and Smith 1982). Thiram has been available for some time, and is reasonably effective against certain cervids, although its method of repellency is unknown (Damas and Smith 1982). Another chemical, **Big Game Repellent** (BGR), is a putrescent egg compound which, although not yet registered in Canada, seems to be effective on a localized basis (for

example, to deter ungulates from drinking roadside pools of salty water) (Damas and Smith 1982). The duration of the repellent effect of such chemicals when applied to roadside vegetation is presently unknown, both in terms of the retention of the substances' repellent properties and animals' habituation to them (Damas and Smith 1982).

Enhancement of habitat away from the highway, through means such as burning, selective clearing, and wetland development, can also be used to reduce roadside grazing (Canadian Wildlife Service 1981). Such action requires careful planning and assessment of ungulate habitat requirements, and it may take a number of years for any changes in habitat utilization to become evident.

Preventing vehicle access to secondary roads in overwintering areas is another possibility for reducing road kills. This approach is being assessed in one part of Kananaskis Country which provides good winter habitat for elk (Pall 1983: pers. comm.).

Sodium has been identified as the ingredient in road salt which attracts animals; thus a substitute for sodium chloride, especially at established kill sites, would remove a major incentive for animals to visit the highway. Sodium chloride (NaCl) has been the compound most frequently used as a highway de-icer – it is cheap, available, and easy to use. Bighorn sheep mortality in Jasper National Park and in the Crowsnest Pass area has been associated with salt application to highways. Many substitute compounds have been tested, but most have at least one major flaw. Calcium chloride ($CaCl_2$) seems to be the most promising alternative although it is more expensive (Damas and Smith 1982). Provision of sufficient salt or mineral licks away from the right-of-way could also help to reduce wildlife road kills, and this is in fact being tried in the Crowsnest Pass area (Gunson 1982: pers. comm.). Even with alternatives to road salt it may take several years to see results, as not only might residual sodium be available but animal movement and behavior patterns must be modified (Damas and Smith 1982).

Improving Drivers' Awareness

Wildlife warning signs (featuring a leaping deer) are found along many highways in Alberta, but they are generally considered to be ineffective at reducing highway-related wildlife mortality (Harrison et al. 1980). Some studies have been done with lighted animated deer crossing signs, and although drivers did slightly reduce their speed, no reduction in animal mortality was observed in areas where deer/auto accidents frequently occurred (Pojar et al. 1975). A more sophisticated signing system has been studied by Ward et al. (1980), and further tests will be carried out on a portion of the Trans Canada Highway through Yoho National Park (Damas and Smith 1982). This is a microwave detection and warning sign system which is activated only when animals enter the roadway corridor. Preliminary tests indicate that this can be an effective method to prevent animal/vehicle collisions, particularly in areas which experience high numbers of road kills due to topographic conditions.

Increased highway lighting to improve drivers' field of view might seem to have potential for reducing animal/vehicle collisions, but this approach is costly and studies have suggested that the method is ineffective (Reed and Woodard 1981) both from this point of view and, as discussed earlier, through deterring ungulate use of rights-of-way.

Preventing or discouraging animal access to highways, as already described, can be costly and requires considerable knowledge of animal behavior. Even so, little research has been done in the other direction, on gaining an understanding of the dynamics of collisions and driver behavior. Damas and Smith (1982) emphasize that wildlife reponses to a myriad of circumstances are unpredictable, and that extreme caution should be exercised whenever an animal is detected. They also summarized studies done in Sweden (VIOL 1980) on the behavior of drivers in connection with game accidents. Firstly, a driver's ability to scan and search the road surroundings improves the chances of spotting animals, but this requires considerable concentration and cannot be maintained for long periods. Secondly, fewer accidents occurred when drivers were alone, suggesting that the manner in which drivers divide their attention while driving is a critical factor in avoiding accidents. Damas and Smith (1982) concluded that the number of collisions could be reduced if drivers (a) are aware that unpredictable animal behavior can be expected, and (b) concentrate on the early detection of animals. To achieve early detection, drivers must know when and where to scan for animals. A public information

program to assist drivers with early detection by advising them of high-risk locations and times is being tried in two Quebec parks and at Terra Nova National Park in Prince Edward Island (Damas and Smith 1982).

CONCLUSIONS

The decision on whether or not to implement measures to reduce wildlife road kills is influenced by many factors. Ultimately, it would seem to depend on which priorities are established and how much an agency is willing to spend. Damas and Smith (1982) suggest that several objectives should be considered when assessing priorities and allocating funds for mitigation; these objectives range from providing complete protection to wildlife from highway mortality to reducing wildlife mortality consistent with public safety standards.

Benefit/cost analysis is one means of assessing the feasibility of mitigation from a purely economic point of view. Such an approach was taken by Reed et al. (1982) in attempting to describe the cost efficiency of fencing and associated structures designed to reduce deer/vehicle accidents. Costs of potential mitigation measures can be fairly easily determined, but other costs and benefits can be difficult to quantify and may be highly variable. Associated with such an assessment is the need to determine what effect road kills are having on wildlife populations.

If there is an abundance of deer, for instance, then perhaps the number killed in collisions is not significant. If, on the other hand, it is found that the number killed by hunters and motorists is having a significant impact on a local population of wildlife, then mitigation might be considered or the number of hunting licences for the area might be decreased.

To date, the number of human fatalities and injuries resulting from animal/vehicle collisions in Alberta is very small. Automobile insurance companies pay to repair vehicle damage and although there is some inconvenience to the motorist, there may be little direct cost. Thus, there seems to be little widespread concern about the need for mitigation in areas outside the national parks. Local spots which have a consistently high number of road kills may warrant special attention, as might areas which are known to be on wildlife migration routes. Leading fences or habitat manipulation to discourage roadside grazing could be adequate measures.

The best data base concerning wildlife road kills exists in the national parks where conditions differ from the rest of the province. To obtain comparable information for the rest of Alberta would be an enormous task, in terms of human and financial resources. At the present time, the general consensus seems to be that, outside the national parks, road kills are having a minimal effect on wildlife populations, with the possible exception of areas which are subject to both heavy hunter use and a high number of road kills. Since successful mitigation requires substantial scientific and financial input, a clear need must be demonstrated before mitigation is considered.

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